A 6.4-hr positive superhump period in TV Col

Retter A., Hellier C. [a]

[a] *Department of Astronomy, Keele University, Staffs., ST5 5BG, UK; ar@astro.keele.ac.uk; ch@astro.keele.ac.uk*

1. Introduction

So far four periods have been discovered in the light curve of TV Col (Hellier 1993). They were interpreted as follows: the 32-min – the spin period; the 5.5-hr period – the orbital binary revolution; the 4-day period – the nodal precession of the accretion disc, and the 5.2-hr period – the beat between the two longer periods (a negative superhump). This interpretation makes TV Col the permanent superhump system with the largest orbital period. Since light curves of many permanent superhumpers show both types of superhumps (Patterson 1999), we decided to search for positive superhumps in the light curve of TV Col as well. Extrapolating the Stolz & Schoembs (1984) relation we predicted that the superhump period should be around 6.4 hr. Indeed we found such a periodicity in the data.

2. Discussion

We re-examined four sets of photometric data of TV Col (Hellier 1993). Three sets show a similar pattern. In the upper panel of Fig. 1 we present the power spectrum of the 1989 January run. There is a triple alias structure around the three marked peaks. Two of them are the known 5.2-hr and 5.5-hr periods. The third peak corresponds to the period 6.4 hr. As a first test, we fitted the two known periods to the data, subtracted them and performed a new power spectrum on the residuals, which is shown in the lower panel of Fig. 1. The third peak didn't disappear from the synthetic power spectrum, but even gained power.

The third period is 0.265+/−0.005 day – about 16 percent longer than the orbital period. It obeys the relation between superhump-period excess and orbital period (Stolz & Schoembs 1984), which is plotted in Fig 2. A positive superhump interpretation is inevitable.

As a confirmed permanent superhumper, the accretion disc of TV Col is naturally thermally stable. Therefore, our result supports the idea of Hellier & Buckley (1993) that the short-term outbursts seen in its light curve are mass transfer events rather than thermal instabilities in the disc.

At 5.5-hr, TV Col has an orbital period longer than any known superhumper, and thus a mass ratio which is probably outside the range at which superhumps can occur according to the current theory.

References

Hellier C., 1993, MNRAS, 264, 132.

Hellier C., Buckley D.A.H., 1993, MNRAS, 265, 766.

Patterson J., 1999, in "Disk Instabilities in Close Binary Systems", Mineshige S., Wheeler C., eds, Universal Academy Press, p. 61.

Stolz B., Schoembs R., 1984, AA, 132, 187.

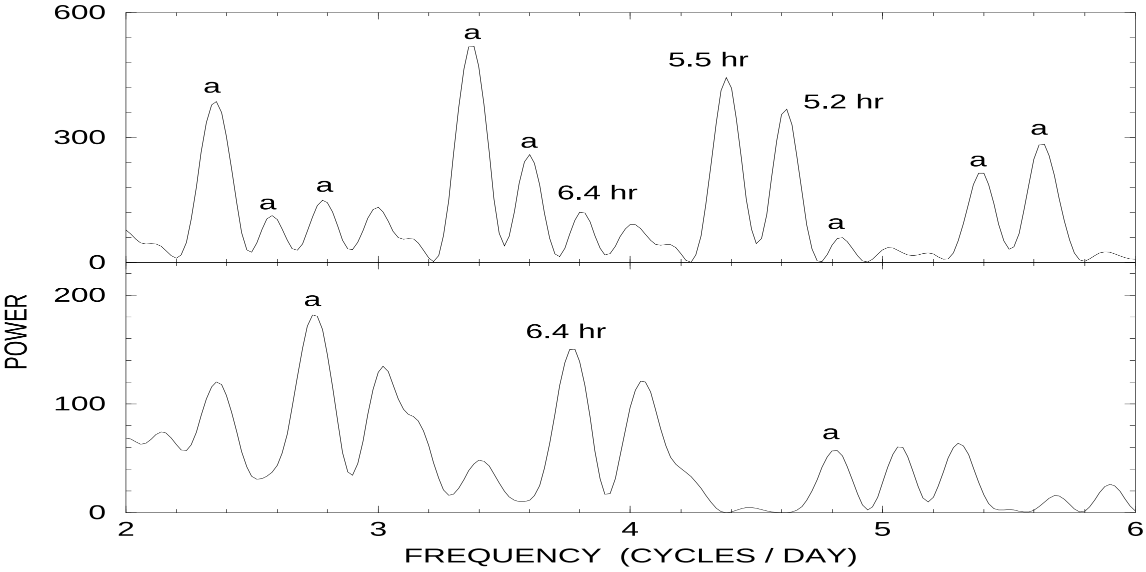

Fig. 1. Upper panel – power spectrum of the nights of 1989 January. The 'a' signs denote 1-day aliases of the three main peaks. Lower panel – the power spectrum after the removal of the two known periods. The difference between the marked 6.4-hr peak and the one just at its right is nearly the nodal precession frequency.

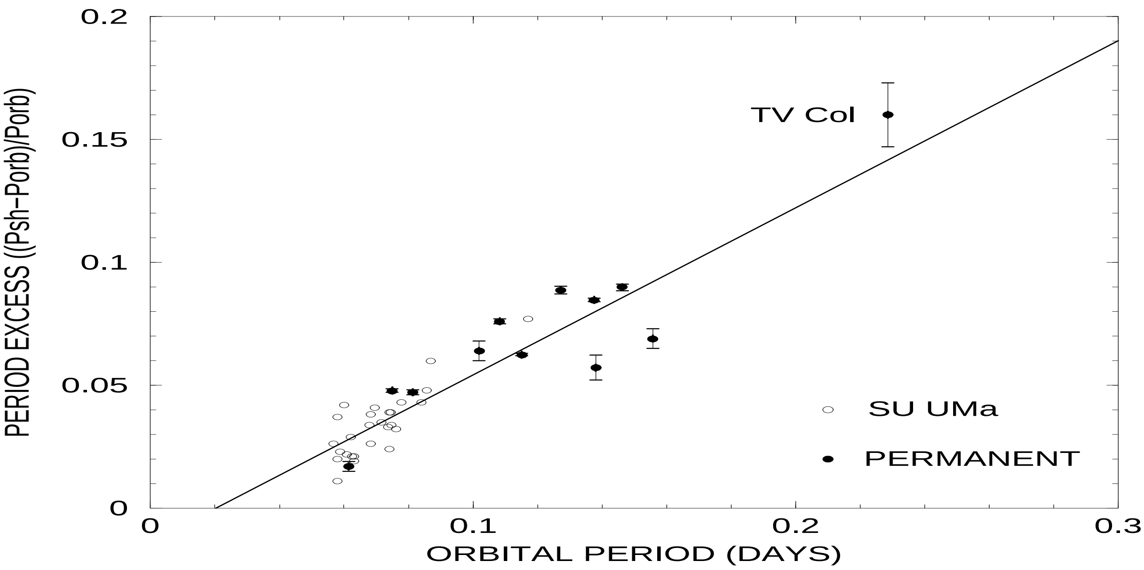

Fig. 2. Stolz & Schoembs (1984) relation for superhump periods. The new period of TV Col obeys the trend.